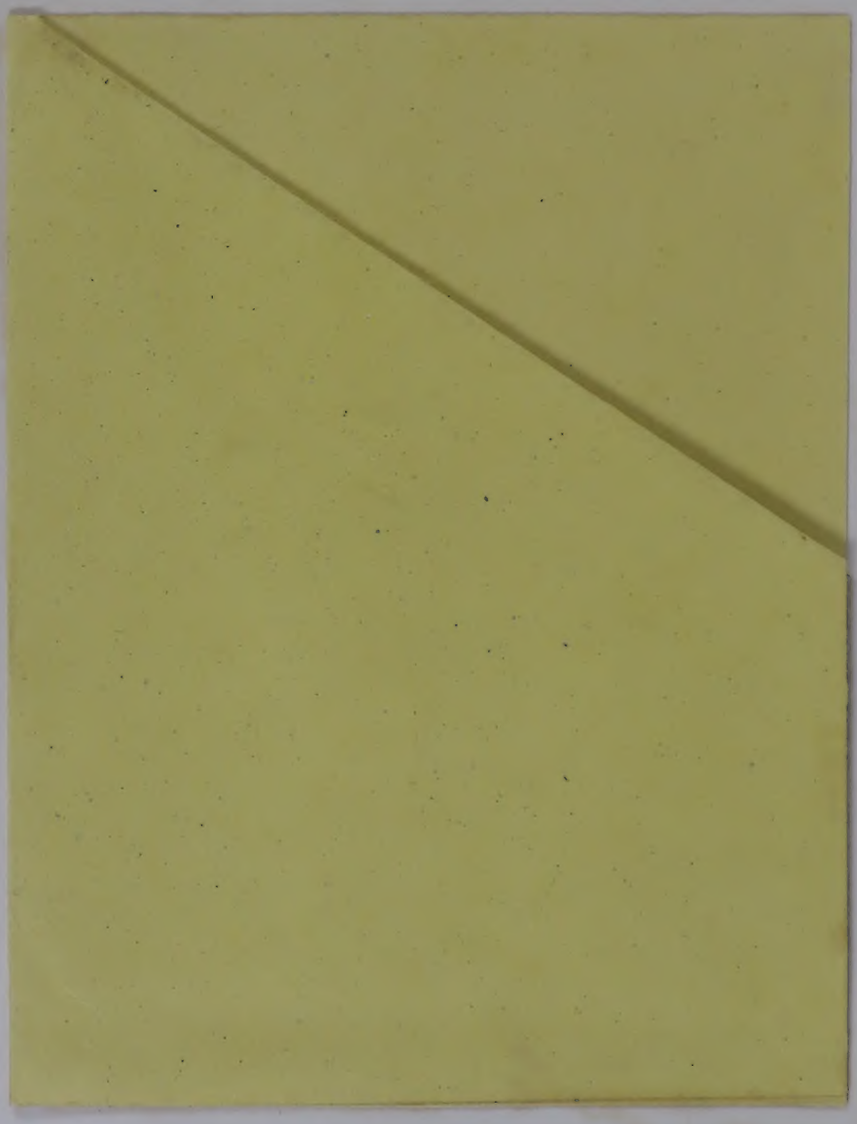
SUPPLEMENTARY FOODS

FOR COMBATING CHILD MALNUTRITION IN INDIA

NEW DELHI
NOVEMBER 1977

FOOD & VILLAGE TECHNOLOGY
UNICEF
SOUTH CENTRAL ASIA REGION



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INTRODUCTION

1. The Problems of Malnutrition

Malnutrition is the biggest single contributor to infant and young child mortality in developing countries. Infant mortality in India in 1974-75 was estimated at 116 per 1,000 live births and for the age group 1-5 years, it was 47 per 1,000. Protein-calorie malnutrition is widely prevalent due to inadequate food supplies and low purchasing power of the people. Occular signs of vitamin A deficiency and manifestations of B-complex deficiency are frequently seen in children. Nutritional anaemia is also common among children due to iron deficiency. At this age, the deficiency can be irreversibly damaging to the mental and physical development of the child.

In India, out of a total population of 620 million, it is estimated that there are about 142 million children below 6 years age with 28 million living in urban and 114 million in rural areas. Every year, at least 14 million babies are added to the population. Food, shelter and education are the basic rights of every child who grows up to contribute to the productive force of the country.

2. Strategies to Meet Food and Nutrition Needs

Malnutrition is a multi-faceted multi-dimensional problem and requires multi-pronged attack. Many strategies are, therefore, to be evolved to deal with this problem. Increased productivity of land, development of food and agro-based industries, nutrification of processed staples, use of non-conventional sources of food by processing, manufacture of low-cost nutritional food mixes coupled with nutrition education and farm extension programmes are the important components to eliminate rural poverty and eradicate malnutrition in the developing countries. Changing food habits is slow, expensive and often a difficult process. New products developed should be associated with on-going food habits of the population and should be acceptable, available, and fill the need.

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3. Feeding Programmes

Many feeding programmes have been launched and are in operation in India under the auspices of the Central and State Governments:

1. Special Nutrition Programme
2. Applied Nutrition Programme
3. Composite Nutrition Programme
4. Family and Child Welfare Programme
5. Feeding children through Balwadis
6. Midday Meals Programme
7. Integrated Child Development Services

4. Supplementary Foods

The supplementary foods distributed are of different categories. Foods are cooked in what are known as "central kitchens" and distributed to the various feeding centres in Madras. Factory-made processed foods like Balahar made out of gifted commodities and indigenously procured/processed materials are made use of in these programmes. Annually, about 30,000 tonnes of Balahar are being produced by the Food Corporation of India through an arrangement with CARE and Government of India. In some areas, "take-home food approach" is tried by which, in selected centres, weekly rations are given to the family members. Food processing is carried out as women's activity in the Indo-Dutch project to supply inexpensive "Hyderabad Mix" for children, while improving the earnings of the poor women. Traditional sweet 'laddus' made out of extracted leaf protein are used in feeding programmes at Coimbatore.

Mention may also be made of the Sukhadi Feeding Programme in 1970 when specially formulated food mix "SUKHADI" was manufactured (40,000 tonnes) and distributed for nutritional improvement and partly as wages in kind. "Energy Food" has already been introduced and well accepted by the beneficiaries in the India Population Project in Karnataka. Government of Karnataka has proposals to set up three manufacturing units for the

production of 'energy food' using locally available food materials in feeding programmes in Raichur, Bellary and Chitradurga districts. Extrusion technology is employed to manufacture large volume of nutritious snacks. Nutritious beverages like 'Miltone', vegetable protein-enriched milk, has been produced in government managed dairies to stretch the available supplies of milk and used for supplementary feeding. Processed roller dried infant cereal-milk foods like Balamul and SWF (Special Weaning Food) have been utilized. Bread and biscuits from public sector undertakings are also used in feeding programmes.

All the above supplementary foods revealed high degree of acceptance. They are made from ingredients locally available, and lend themselves to nutrification for upgrading the nutritional status of the people. They are also compatible with the prevailing food habits and hence could have good market potential through the existing trade channels. There are many socio-economic advantages in promoting food processing centres in rural areas employing low-cost labour-intensive technologies to suit the local needs utilizing the indigenous resources. A few cases of supplementary foods used for feeding programmes in India are briefly outlined in this report.

D.V.S.K. Rao
Food & Village Technology

New Delhi
November 1977

1. WIN FOOD

1. Project location : The Gandhigram Institute of Rural Health & Family Planning
Gandhigram P.O.
Madurai District
Tamil Nadu.

The project started in 1970.

2. Product details and raw materials used : "SATHU MAVU" means Food for Strength and Growth

Cambu (millet) flour roasted;
Greengram dal flour roasted;
Groundnut cake flour roasted;
Jaggery.

Selected out of 23 test formulations.

3. Plant details - capacity etc. : No special plant is required for producing Win Food except clean household utensils for roasting and mixing the roasted ingredients.

4. Processing details : The ingredients are roasted separately, powdered and mixed with jaggery in a certain proportion.

5. Nutritional data : It has been proved that 100 gm of Win Food provides about 20 gm of protein and 400 calories.

Composition per 100 gm

Protein	19.8	g
Fat	4.6	
Calories	405.8	
Calcium	101.6	mg
Phosphorous	353.75	mg
Iron	10.2	mg
Vitamin A	122.45	IU
Thiamine	0.227	mg
Riboflavin	1.025	mg
Nicotinic Acid	2.16	mg

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6.	Test results	: Trials have been conducted in a village. Intensive and extensive nutrition education was provided. Preparation of food was demonstrated, street by street, daily for a month. The sale went up from 340 packets a month in May 1970 to 3250 packets a month by June 1971.
7.	Distribution pattern	: The food was cooked as porridge in the presence of mothers before serving their children; the recipe flour was distributed to mothers to involve them actively in the feeding programme; phased education/ feeding continued for one month before moving to the next village; finally feeding programme was discontinued and sale of packets promoted.
8.	Cost of production and distribution	: The cost of a packet of 100 gm is about 10 paise. It is estimated that per paise, it provides 2 gm of protein.

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2. KERALA INDIGENOUS FOOD (KIF)

1. Project location : Kerala Indigenous Food (KIF) Project
Malappuram
Kerala

The project started in July 1971.

2. Products details and raw materials used : (1)

Tapioca	70%
Groundnut	30%

Vitamins and minerals as in the case of Balahar.

(2)

Tapioca	60%
Groundnut	30%
Soya	10%

(3)

Wheat	50%
Tapioca	25%
Groundnut	25%

(4)

Tapioca	200	g
Fish powder	15	g
Oil	5	ml

Gives 395 calories and 11.5 g of protein. Parbpiled tapioca is used.

3. Plant details - capacity etc. : Tapioca chips are broken into grits in a disintegrater and then fed into a mill for powdering. This flour is sieved and blended with groundnut flour and vitamin-mineral mix together with any other ingredients which are to be included to form KIF. This is then bagged and stored.

4. Processing details The groundnut cake goes through a similar process before going into the blender. The size of the grain is not important since it disintegrates on cooking.

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5. Nutritional data :

Food		Calorie	Protein
Bulgar wheat) CSM)	98 gm	344	14.67
Tapioca) Groundnut) Soya)	100 gm	410	23
Tapioca) Groundnut)	100 gm	400	15
Tapioca) Groundnut) Bulgar wheat)	100 gm	395	20

6. Test results : Tests have been conducted by CFTRI and Medical College, Trivandrum and it is concluded that these formulations could be adopted for the production of KIF to be used for feeding programmes.

Also, KIF made with tapioca and fish powder has proved that if provided at a low cost to the consumer will be readily acceptable.

7. Distribution pattern : KIF has almost replaced CARE programme for school feeding and feeding of pregnant and nursing mothers and also the Special Nutrition Programme.

8. Cost of production and distribution : Cost varies from 15 paise to 20 paise per ration of 100 gm of different formulae.

7 gm of salad oil costs 2.7 paise
7 gm of groundnut oil costs 3.5 paise.

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3. KUZHANDAI AMUDHU (Child's Nutritious Food)

1.	Project location	: Sri Avinashilingam Home Science College for Women Coimbatore.
2.	Product details and raw materials used	: There are several formulations with jowar, Bengal gram, groundnut, jaggery, ragi, maize and green gram.
3.	Plant details - capacity etc.	: No special plant is required except pans for roasting and a flour mill to make flour and grind jaggery and then mix them all together.
4.	Processing details	: Roast the pulses and cereals and grind to a fine powder. Also powder the jaggery and then mix all the ingredients.
5.	Nutritional data	: 100 gm of the product provides 375-400 calories and 11.7-13.6 protein.
6.	Test results	: The institute conducted trials and found this infant food to be suitable for supplementary feeding programmes. Towards the end of the experiment conducted by the institute, children receiving the product were heavier and taller than their counterparts in the control group. The mean differences for the increases in heights and weights were significant statistically at one per cent level.

7. Distribution pattern: The food is produced in the school premises where it is distributed to the children.

8. Cost of production and distribution : The cost for 100 gm varies from 18-20 paise per ration and works out to 23-25 paise including cost of distribution.

9. Other information : Acceptability trials revealed that children accepted the product prepared from local foods very well. Its acceptability was even greater than that for CSM. The different formulations and the respective costs are detailed in the following page.

How to use it

30 ml of water (boiled cooled or boiling) can be added to 100 gm of the formulation and made into balls designated as laddus.

Porridge can be prepared by adding 10 ml of boiling water.

Items like iddli, dosai, adai, chappati and kolukkattai can also be prepared, depending upon the facilities available.

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KUZHANDAI AMUDHU - DIFFERENT FORMULATIONS

Ingredients	Amount mg	Calories	Protein gm	Cost Rs. p
1. Jowar-Bengal gram formulation				
Roasted jowar flour	37.5	131	3.9	0.05
Roasted Bengal gram flour	25.0	92	5.6	0.06
Roasted groundnuts	12.5	71	3.3	0.07
Jaggery	25.0	96	0.1	0.06
	100.0	390	12.9	0.24
2. Jowar-Green Gram formulation				
Roasted jowar flour	37.5	131	3.9	0.05
Roasted green gram flour	25.0	87	6.1	0.05
Roasted groundnuts	12.5	71	3.3	0.07
Jaggery	25.0	96	0.1	0.06
	100.0	385	13.4	0.23
3. Maize-Bengal gram formulation				
Roasted maize flour	37.5	128	4.1	0.06
Roasted Bengal gram flour	25.0	92	5.6	0.06
Roasted groundnuts	12.5	71	3.3	0.07
Jaggery	25.0	96	0.1	0.06
	100.0	387	13.1	0.25
4. Maize-Green gram formulation				
Roasted maize flour	37.5	128	4.1	0.06
Roasted green gram flour	25.0	87	6.1	0.05
Roasted groundnuts	12.5	71	3.3	0.07
Jaggery	25.0	96	0.1	0.06
	100.0	382	13.6	0.24
5. Ragi-Bengal gram formulation				
Roasted ragi flour	37.5	123	2.7	0.05
Roasted Bengal gram flour	25.0	92	5.6	0.06
Roasted groundnuts	12.5	71	3.3	0.07
Jaggery	25.0	96	0.1	0.06
	100.0	382	11.7	0.24
6. Ragi-Green gram formulation				
Roasted ragi flour	37.5	123	2.7	0.05
Roasted green gram flour	25.0	87	6.1	0.05
Roasted groundnuts	12.5	71	3.3	0.07
Jaggery	25.0	96	0.1	0.06
	100.0	377	12.2	0.23

4. SUKHADI

1. **Project location** : Sadguru Seva Sangh Trust
Bombay
(A charitable institution run by industrialist, Arvind Mafatlal).

Started distribution in Gujarat in 1970.

2. **Product details and raw materials used** :

CSM	60 parts
Salad oil	10 parts
Jaggery	30 parts

CARE supplies the CSM and salad oil. Sometimes, bulgur wheat ground to 30 mesh size is used instead of CSM.

3. **Plant details - capacity etc.** : Mildly roast CSM for 5 minutes with a little oil in a circular pan (4 ft dia. x 1½ ft) made of ¼" thick mild steel. Simultaneously, heat 30 kg of jaggery powder with remaining oil in a similar pan for

4. **Processing details** : 4 minutes. Roasted CSM is taken in buckets and mixed with the heated jaggery for about 2 minutes. The heating of pans is done by oil fired burners on specially designed ovens. The final step is to sieve the mixture to separate the jaggery lumps. This is done on a ¼" mesh wide screen placed on a 3ft high platform over a length of 40 x 2½'.

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5. Nutritional data : This is in a granular ready-to-eat form which can be eaten dry or mixed with boiled water and fed to children as porridge. It is readily accepted because of its sweetness.

100 gm of the product provides 19 g protein and 347 calories. WSB sukhadi provides 20 g protein and 360 calories per 100 g of product.

Composition per 100 gm

Calories	347	
Protein	19	g
Fat	13.5	gm
Carbohydrates		gm
Vitamin A	1250	IU
Vitamin D	120	IU
Vitamin E	5.2	IU
Thiamine	0.4	mg
Riboflavin	0.35	mg
Niacin	3.8	mg
Vitamin B_6	0.3	mg
Vitamin B_{12}	2.4	µg
Pantolhenic Acid	2.2	mg[x]
Folacin	0.2	mg
Ascorbic Acid	24	mg
Calcium	0.31	gm
Phosphorous	0.23	gm
Iron	14	mg
Magnesium	67	mg
Sodium	170	mg[x]
Potassium	362	mg[x]
Iodine	30	µg
Zinc	1	mg[x]

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6. **Test results** : Tests have proved that Sukhadi is increasingly accepted for feeding programmes because of

- low cost ready-to-eat form made from pre-cooked ingredients;
- the sweet component - crude jaggery - which is acceptable to all households;
- the pleasant appealing roasted taste and flavour.

7. **Distribution pattern**: In 1970, a daily average of 5 lakh beneficiaries were fed during a 7 month period for an emergency drought relief programme. During the following year in Maharashtra, it was fed during a scarcity programme. In 1974, 175,000 pre-school and pregnant/ nursing mothers at over 1450 centres in 12 districts of Maharashtra received Sukhadi under the Special Nutrition Programme.

8. **Cost of production and distribution** : Cost of raw materials

CSM	12.0 paise for 60 gm
Oil	4.0 paise for 10 gm
Jaggery	4.9 paise for 30 gm
Preparation	0.9 paise
Transportation to centres	2.1 paise

9. **Other information** : Sukhadi can be fed 300 days in a year. The cost per beneficiary is about Rs. 25/-

Shelf-life is reported to be about three months.

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5. BALAHAR (CHILDREN'S FOOD)

1.	Project location	: There are quite a number of wheat flour mills in India which, under the guidance of the Food Corporation of India, manufacture Balahar with different formulations. Most of them started operation as early as 1964.
2.	Product details and raw materials used	: With different proportions of the following raw materials: Wheat Bulgur wheat Bulgur wheat (15% soya fortified or CSM) Soya flour (defatted) Groundnut flour Bengal gram flour Maize Vitamin-mineral mix
3.	Plant details - capacity etc.	: Grinding mill Blenders Entoleter Bagging Machine
4.	Processing details	: The raw materials are crushed and ground to 600 micron size and blended with vitamin-mineral mix and packed in 25 kg poly bags (300 gauge) inserted in between bags.

5. Nutritional data :

		%	
Protein (N 6.25) Dry basis	min	21	
FPS	min	0.02	
Total ash (Dry basis)		3.0	
Acid insoluble ash		0.2	
Moisture	max	10.0	
Crude fibre		3.5	
Aflatoxin		0.03	ppm

	Per ton	
Vitamin A	26	g
Vitamin B_1	3	g
Vitamin B_2	4	g
Vitamin B_{12}	34	mg
Niacin	50	g
Folic acid	340	mg
Di-cal phosphate	4	kg

6. Test results : After every batch of production, a sample is taken by FCI and forwarded to the GOI laboratory of the Department of Food where tests are conducted and after their approval, the batch is released for distribution. Field trials have been conducted on Balahar and found quite suitable for feeding programmes, especially in emergencies.

7. Distribution pattern : It is distributed by CARE in school feeding programmes. UNICEF procured 25,000 tonnes of Balahar during 1975 for the Special Relief Programme in flood affected areas in northern states. Balahar was made to various formulations as shown on pages 17 and 18 depending on the availability of raw materials.

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8.	Cost of production	: FCI were charging Rs 3,000 per MT for the product.
9.	Other information	: About 75 gm of Balahar per child per day is recommended which gives about 300 calories and about 15 g of good quality protein. The PER of different formulations of Balahar was found to be between 1.8 and 2.0.

Production during the last few years :

1969/70	7,502 tons
1970/71	8,681 "
1971/72	15,598 "
1972/73 (till 15 Sept '73)	14,297 "
1973/74	13,310 "
1974/75	29,884 "
1975/76	32,631 "
1976/77	43,362 "

In 1975/76, UNICEF alone purchased 25,000 MT for their Special Child Relief Programme.

Production centres : Balahar for UNICEF-assisted Special Child Relief Programme was produced by FCI in wheat flour mills at Bombay, Calcutta, Madras, Indore, Bareilly and Faridabad.

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BALAHAR COMPOSITIONS FOR UNICEF FEEDING PROGRAMMES

CODE	FORMULATIONS		ANALYTICAL VALUES PER 100 G OF PRODUCT				
	Ingredients	%	Protein (min)	Calories	Fat	Carbohydrate	Crude fibre (max)
BH-1	Soya fortified bulgur (SFB) Groundnut flour	85 15	21	345	1.0-2.5	62.0	3.5
BH-2	SFB Bengal gram flour	85 15	17	346	"	66.0	3.5
BH-3	Maize semolina Soya flour defatted Groundnut flour	70 15 15	21	345	"	62.0	3.5
BH-4	Maize flour Soya flour Bengal gram flour	65 25 10	21	345	"	62.0	3.5
BH-5	SFB Bengal gram flour	90 10	17	344	"	66.0	3.5

Vitamin-Mineral Premix — All formulations are enriched by adding per 1 ton of Balahar 4 kg V-M mix (costing Rs 55.57) containing the following:

Vitamin A	.. 26 g	Vitamin B_{12}	.. 34 mg
Vitamin B_1	.. 3 g	Folic acid	.. 340 mg
Vitamin B_2	.. 4 g	Dicalcium phosphate	.. 4 kg

BALAHAR COMPOSITIONS FOR UNICEF FEEDING PROGRAMMES

CODE	FORMULATIONS	ANALYTICAL VALUES PER 100 G OF PRODUCT					
	Ingredients	%	Protein (min)	Calories	Fat	Carbohydrate	Crude fibre (max)
BH-6	Whole wheat flour Groundnut flour Soya flour	70 15 15	17	350	1.0-2.5	62.0	3.5
BH-7	Whole wheat flour Groundnut/soya flour Bengal gram flour	65 25 10	17	350	1.0-2.5	66.0	3.5
BH-8	Rolled oats Skim milk powder	89 11	16 (18)	350 (379)	5	62.0	3.5
BH-9	Rolled oats Skim milk powder	83 17	16	350	5	62.0	3.5
	Feed ration of BH-8 per day for:	g					
	Child 2-6 years) Pregnant mother)	125	20	437			
	Nursing mother	250	40	874			

Notes: (a) Computed values given in (...)
(b) Vitamin-mineral mix added as per standard Balahar formulations

6. PAUSHTIKAHAR (AGRA MIX)

1. **Project location** : Agra
Uttar Pradesh
(Dist. Basic Education Office)

Started in August 1976 with WFP assistance.

2. **Product details and raw materials used** :

	kg/batch
Soya fortified bulgur/ soya fortified wheat grits	17.0
Butter oil	2.1
Sugar (crude sugar powder)	2.0

3. **Plant details - capacity etc.** : Iron roasting pan 3' dia x 1½" deep;
Cylindrical oven 18" wide x 24" high for coal heating the pan;
Long wooden poles for agitating the mix;
Trays to collect the roasted mix;
Sieves;
Weighers;
Packing material.

4. **Processing details** : The oil is added in the iron pan which is heated by coal on the cylindrical oven. SFB is then added to the heated oil and the mix is agitated manually with the long wooden polewith an attached wide metal scraper blade. Sugar powder is added to the roasted flour and agitation is continued. The mix is then scooped out into trays which are suspended by ropes from the ceiling beam. Processing is done by labour. The final product is packed 30 kg in the original imported raw material bags.

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The above plant is located in a residential type government building with a total area of 80' x 60'. The raw materials are stored on wooden planks in two separate rooms (80'x20'x10') The roasting and weighing is done in a covered backroom while sieving of the roasted mix is done in a separate room, adjacent to the processing space.

5. Nutritional data : It is envisaged that 80 gm of the product will be sufficient for supplementary feeding of a child and 125 gm for a pregnant/lactating woman per day.

6. Test results : Not known.

7. Distribution pattern : The product is delivered to the 100 school centres on four cycles, each cycle carrying a 30 kg bag per trip and doing 7-8 trips a day. The four cyclists are paid Rs 45/- per day by the contractor for covering 33 centres and thus covering all 100 centres within three days to deliver food for 10,000 beneficiaries.

8. Cost of production and distribution : During the year ending April 1977, total processing and delivery costs amounted to Rs 131,886. While 269162.66 kg of SFB and SFG and 20,000 kg of butter oil was supplied free of cost by the World Food Programme, the Government spent on sugar and masala, a sum of Rs 52,419. A sum of Rs 67,449 was spent on processing including milling, cooking, mixing and packaging. Cost of transportation was Rs 12,018.

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9. Other information : The Government of Uttar Pradesh launched the Paushtikahar scheme in Agra in August 1976. The product is distributed to feed about 9,000 children and 1,000 pregnant and lactating women in 80 local primary schools and 20 social organizations, all within 5-6 miles from the production centre. Most children eat the powder as such in the school itself while some take it home to eat it after reconstituting with hot water or milk. The school feeding is done for 24 days per month and thus for 11 months per year. There are in all 14 persons in employment for running this programme. At primary school on Aulia Road about 100 beneficiaries in the Rs 100-150 income bracket and about 30 beneficiaries in the 1-3 age group are fed.

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7. HYDERABAD MIX

1. Project location : Indo-Dutch Project for Child Welfare
Chevalla Block
Hyderabad
Andhra Pradesh

2. Product details and raw materials used :

Wheat/jowar	35.0 g
Bengal gram	11.5 g
Groundnut	6.0 g
Sugar/jaggery	11.5 g
Skim milk powder/ soya flour (defatted)	6.0 g

3. Plant details - capacity etc. : No special plant is available. Cleaning, roasting and grinding is done by local members of Mahila Mandals (women's organizations). Monthly consumption is about 3,000 packets.

4. Processing details : The raw materials are cleaned, roasted, ground and then packed in small packets.

5. Nutritional data : Each 70 gm packet provides

Protein	10 gm
Calories	250
Vitamin A	50 IU

6. Test results : Trials have proved

- increase in weight at the end of four weeks (0.66 kg average).
- increase in weight from second week.
- reduction of oedema fluid from first week.
- improvement in mental changes, subsidence of diarrhoea and puffiness of face in second week.

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7.	Distribution pattern	: The mix can be fed as - plain powder; - porridge with jaggery; - jaggery balls (laddus); - bread cakes (chappattis).
8.	Cost of production	: A 70 gm packet of the mix costs Rs 0.35 paise.
9.	Other information	: Produce of the demonstration unit grown by local farmers established in Kanakamamidi is donated to the project.' Mahila Mandals produce the protein packs and distribute to nursery schools and creches. This provides the chain - demonstration on high yielding crops; methods of preparing protein packs at village level; utilizing the packs in different ways for mothers and children; controlling malnutrition; and encouraging local mothers to use this mix at home.

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8. ENERGY FOOD

1. Project location : Central Food Technological Research Institute
Mysore

in technical collaboration with

National Institute of Nutrition
Hyderabad

Since 1974/75.

2. Product details and raw materials used :

Wheat flour	60 parts
Bengal gram flour	10 parts
Groundnut flour (expeller)	10 parts
Jaggery powder	30 parts

3. Plant details - capacity etc. : Energy food is produced in the pilot plant section provided with wheat cleaning and destoning, roasting, grinding and blending equipment. A few rotating bowl-type Bharat electric roasters are used which can roast as well as powder at about 50-200°C within 5-10 minutes. Jaggery is powdered in a Gansons multimill.

4. Processing details

5. Nutritional data :

Composition per 100 gm

Protein	12-15 %
Fat	2-3 %
Crude fibre	0.5-1 %
Calories	400

6. Test results : CFTRI, Mysore have produced this material on pilot scale and tests were conducted before introducing the product in child feeding programmes.

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7. Distribution pattern : Older children can eat the powder as such while infants should be fed after cooking it for five minutes before feeding.

8. In the beginning, it was distributed free of cost in a feeding programme financed by the World Bank. Since August 1974, it is being supplied to a feeding programme for children in the age group of 6 months to 2 years old in Chittadurg, 200 miles from Mysore. Mothers are given 100 gm and children 50 gm of the powder. Since then, the distribution has been expanded to other districts of Karnataka.

8. Cost of production and distribution : In 1973, 100 gm of the product cost approximately 25 paise. Calcium carbonate is added in the mix at 1 per cent level. In August 1974, the price of 100 gm was 30 paise. By October 1974 the price rose to 35 paise per 100 gm because of the cost of raw materials and packaging materials.

9. Other information : The product can be stored for 3-4 months at 37°C. A sample with 5% fat was found very popular, but expensive.

A cost estimate of plant and machinery for an energy food plant is detailed on the following page.

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COST ESTIMATE OF PLANT & MACHINERY FOR ENERGY FOOD PLANT

Plant capacity : 1 tonne per shift

		Rupees
Destoner	for wheat and Bengal gram	25,000
Grain roaster (10 bags per hour)	for soyabean, maize and Bengal gram	70,000
Bharat electric roaster (35 kg per batch)	for Bengal gram	17,000
Bharat pan roaster	for groundnut cake	15,000
Ganson multimill	for jaggery	15,000
Monarch hammermill (500 kg per hour)	for wheat and Bengal gram	25,000
Plate mill	for groundnut cake	1,000
Two ribbon mixers tilting type (150 kg per batch)		36,000
Bins, trolleys, etc.		10,000
Packing machine - heat sealers		10,000
Platform balance and scales		15,000
Electrical equipments & laboratory equipments		16,000
Erection charges @ 10%		25,000
	Total estimated cost of plant	Rs. 280,000

STAFF

For production	10
For packaging	10
Supervisor	1

The cost of a similar plant with capacities of 2 tonnes and 4 tonnes per shift will be about Rs 4 lakhs and Rs 5 lakhs respectively.

9. BALAMUL

1. **Project location** : Weaning Food Plant
Mogar Complex
Anand, Gujarat

The project started by end 1971.

2. **Product details and raw materials used** : Defatted soya flour
skimmed milk solids
cereals and legume flours
sugar
vitamins
minerals

3. **Plant details - capacity etc.** : The plant has a capacity of 6,000 tonnes per annum.

The equipment supplied by UNICEF includes:

- roller driers
- powder filling and packaging machines
- extrusion cooker

4. **Processing details** : (a) Balamul is prepared by roller drier process for all India commercial market

(b) Extruded foods on Wenger cooker.

5. **Nutritional data** :

Composition per 100 gm		
Protein	22	g
Calcium	1	g
Vitamin A	1500	IU
Vitamin B	0.5	mg
Vitamin B_2	0.6	mg
Vitamin C	50	mg
Vitamin D	300	IU
Carbohydrates	60	g
Phosphorous	0.8	g
Niacinamide	5	g
Fat	7	g
Iron	6	mg

Extruded foods have a minimum of 15% protein and about 8% fat and is available in sweet and savoury types in various shapes.

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6. Test results : The formulation was prepared by the Central Food Technological Research Institute, Mysore and tests were conducted at the Vellore Hospital with very good results. The formulation also conforms to PAG guidelines.

7. Distribution pattern: AMUL has got an excellent marketing organization and sells through their outlets on an all India commercial basis.

8. Cost of production and distribution :

Raw materials including product loss	35%
Processing	7%
Packaging materials	31%
Advertising	4%
Distributor commission, central sales tax and retailer commission	23%
Wheat, full-fat soya, skim milk powder and sugar (45-50% is for smp)	89%
Vitamins, minerals and flavouring	11%

Cost of Balamul Rs. 6.40 per ½ kg
Rs.10.80 per 1 kg

Cost of ½ kg tin	Rs. 1.80
Cost of 1 kg tin	Rs. 3.60
Total packaging cost including cartons	Rs. 4.90

9. Other information : This is a successful example of a farmers' cooperative supported by the Government of India and assisted by UNICEF in its development from the very beginning.

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10. SPECIAL WEANING FOOD - "SWF"

1.	Project location	: Weaning Food Plant Mogar Complex Anand, Gujarat Started in December 1974.
2.	Product details and raw materials used	: Eight formulations of SWF have been developed with various raw materials including imported rolled oats. Full-fat soyaflour, wheat flour, sugar and vitamin-mineral mix are some of the other ingredients. The product can be easily reconstituted. In a particular formulation, calcium caseinate is also used. SWF has a shelf-life of about six months.
3.	Plant details - capacity etc.	: The weaning food plant at Mogar has a production capacity of 6 tons/day. The plant supplied by UNICEF for making BALAMUL has a complete range of equipment including a roller drier and packaging machinery.
4.	Processing details	: The product is prepared in 250 kg batches in a 1200 litre kettle and cooked at 60°C (40% solids) for 15 minutes and the batch runs for about 45 minutes in a roller drier. The drying time on the roller drier is about 7 seconds. The dried product is later blended in 200 kg batches with vitamin-mineral premix for 10 minutes and sifted through a 40 mesh sieve to get fine, free-flowing powder. The resulting 'instant' powder needs no further cooking; it can be reconstituted by mixing with cold or hot water to the desired consistency for feeding purposes.

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5. Nutritional data : 100 gm of the product provides 15 gm of protein and 360 calories.

		%
Protein	min	15
Moisture	max	4
Crude fibre	max	3.5
Total ash	max	4
FFA	max	0.02
Calories per 100 gm	min	360

	Per ton	
Vitamin A	26	g
Vitamin B_1	3	g
Vitamin B_2	4	g
Vitamin B_{12}	34	mg
Folic acid	340	mg
Di-calcium phosphate	4	kg

The PAG guidelines state that the weaning food should be free from E-coli; ISI specifications state that bacterial count should not exceed 50,000 per gm.

A typical analytical result of a test of a sample supplied in December 1974 is as follows:

Moisture	%	1.77
Protein	%	15.66
Total ash	%	2.02
Acid insoluble ash	%	0.042
Total plate count		30,000
E coli		nil
Colour		satisfactory
Taste		satisfactory
Flavour		satisfactory
Appearance		O.K.

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6. Test results : Tests have been conducted by the laboratory at Anand as well as by the Food Laboratory at Delhi of the Department of Food, GOI and was found to be quite acceptable and in conformity with the PAG guidelines.

7. Distribution pattern : UNICEF, during the Special Child Relief programme in India during 1974-76, has widely used this product in large quantities through the outlets established for the purpose.

8. Cost of production and distribution : The product was obtained from the manufacturers at the rate of Rs 5/- per kg. UNICEF provided the raw materials such as milk powder and wheat flour. No taxes are included since UNICEF is exempt from payment of taxes such as sales tax, octroi, etc.

9. Other information : Formula of SWF mostly used:

Wheat flour	69%
Soya flour	20%
Sugar	10%
Salt	1%

Vitamin-mineral mix is added per 1000 kg of product subsequently to the roller dried product at levels indicated.

A number of formulations given on pages 32 and 33 were employed depending upon the availability of raw materials donated by different countries.

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SWF COMPOSITIONS FOR UNICEF FEEDING PROGRAMMES

Code	Formulations		Analytical values per 100 g of product		Price
	Ingredients	%	Protein Min	Calories Min	Rs/ton
SWF-1	Wheat flour Soya flour Sugar Salt	69 20 10 1	15	360	5000
SWF-2	Wheat flour Soya flour Salt	79 20 1	15	360	5000
SWF-3	Wheat flour Soya flour Sugar Salt	71 20 8 1	15	360	5000*
SWF-4	Wheat flour Soya flour Calcium caseinate Sugar Salt	69 6 10 14 1	15	360	3750**

Vitamin-Mineral Mix

All formulations are enriched by adding per 1 ton of SWF, 4 kg V.M. Mix contain- the following:

Vitamin A	26 g
Vitamin B_1	3 g
Vitamin B_2	4 g
Vitamin B_{12}	34 mg
Folic acid	340 mg
Di-calcium phosphate	4 mg

* 4600 with UNICEF-supplied sugar
** with UNICEF-supplied sugar and calcium caseinate

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SWF COMPOSITIONS FOR UNICEF FEEDING PROGRAMMES

Code	Formulations		Analytical values per 100 g of product		Price
	Ingredients	%	Protein Min	Calories Min	Rs/ton
SWF-5	Wheat flour Skim milk powder Full-fat soya flour Butter oil Sugar	61 15 10 6 8	15	360	
SWF-6	Wheat flour Skim milk powder Butter oil Sugar	61 25 6 8	15	360	
SWF-7	Rolled oats Skim milk powder Sugar	67 25 8	15	360	1750
SWF-8	Wheat flour Skim milk powder Sugar	67 25 8	15	360	1750
	Feed ration at feeding centres SWF-8 Butter oil	g 85 10	12.8	430	

Note: Standard vitamin-mineral mix is used in all the formulations as in Balahar.

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11. PROTEIN PLUS AND NUTRINUGGETS

1.	Project location	: Soya Production and Research Association 182 Civil Lines Bareilly 243001
2.	Product details and raw materials used	: Nutrinuggets textured vegetable protein made from defatted soya flour having 50% protein. Protein Plus instant infant food made from corn and soya flour.
3.	Plant details - capacity etc.	: Wenger X-25; Wenger X-155 of larger capacity recently imported.
4.	Processing details	: The product is cooked by extrusion under pressure at high temperature and shaped into articles or packed as granules.
5.	Nutritional data	: 100 gm of Protein Plus provides 20 gm protein and 330 calories and required vitamins and minerals.
6.	Test results	: The association has conducted trials on the above products.
7.	Distribution pattern	: The products are in the commercial market for the last five years in all major cities. Protein Plus is also used by the Government for feeding programmes in some states.
8.	Cost of production and distribution	: Nutrinuggets are offered at Rs.6.50 per kg. ex. Bareilly in bulk packing; Protein Plus at Rs.4.50 per kg.
9.	Other information	: Protein Plus is exempted from excise duty of the Government of India.

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12. SHAKTIAHAR

1. **Project location** : Soya Production and Research Association
182 Civil Lines
Bareilly 243001

Started in 1973/74.

2. **Product details and raw materials used** : Inexpensive corn-soya product for feeding programmes made of

(a)

puffed maize	44%
full-fat soya	40%
Sugar	14%
Vitamins & minerals	1%
Salt	1%

(b) Shaktiahar is, however, fully cooked full-fat soya flour.

3. **Plant details - capacity etc.** : Wenger extrusion cooker X-25 with 0.5 MT per hour capacity.

4. **Processing details** : Both cooked on Wenger extrusion cooker.

5. **Nutritional data** : Shaktiahar contains 20% oil, 40% protein, 40% carbohydrates and provides 448 calories per 100 gm.

To have 300 calories and 15 gm protein, a child should get a ration of 75 gm of the product.

6. **Test results** : Analysis and test results have proved the acceptability of the product.

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7.	Distribution pattern:	Significant quantities of this product have been supplied for feeding programmes and during the Bihar floods.
8.	Cost of production and distribution	: The cost of this inexpensive product is Rs 4/- per kg. Sales tax, transportation and other handling charges are extra. Shaktiahar is offered at Rs.4/50 per kg.
9.	Other information	: The product has only to be mixed in water and served as a gruel to children.

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13. PAUSHTIKAHAR

1.	Project location	: Soya Production and Research Association 182 Civil Lines Bareilly 243001
2.	Product details and raw materials used	: Soya Maize Vitamin-mineral pre-mix
3.	Plant details - capacity etc.	The product is manufactured in the same factory where Protein Plus and Nutrinuggets are made.
4.	Processing details	: It is mixed and ground in a coarse form. If necessary, it can be ground to 20-40 mesh in uniform level.
5.	Nutritional data	: 100 gm of the product provides 400 calories and 20 g protein.
6.	Test results	: Tests have been conducted and in three months about 160 tons of the product were supplied to the State Government of Uttar Pradesh for use in their feeding programmes. Trials have been conducted in Bareilly and at St. Stephen's Hospital in Delhi.
7.	Cost of production and distribution	: This product costs approximately Rs 4.25 per kg ex.factory.
8.	Other information	: The product can be matched with the quality of milk and can be used in places where milk is in short supply.

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Nutrient	Amount contributed by 100 gm	Percentage of recommended daily dietary allowances provided by 100 gm of Paushtikahar							
		1-2 year child		3-4 year child		Adults above 22 yrs			
						Male		Female	
		MDR	%age provided	MDR	%age provided	MDR	%age provided	MDR	%age provided
Energy (Cal)	400	1200	33.3	1350	29.6	2800	14.3	2200	18.2
Protein (gm)	20	17	117.0	21	95	55	36.5	45	44.5
Vitamins									
A	1300 IU	900	144.4	900	144.4	3000	43.3	3000	43.3
B_1	0.3 mg	0.46	65.2	0.58	51.7	1.4	21.4	1.0	30.0
B_2	0.4 mg	0.63	63.5	0.8	50.0	1.7	23.5	1.5	26.7
B_6	0.3 mg	0.50	60.0	0.7	42.9	2.0	15.0	2.0	15.0
B_{12}	0.0034 mg	0.002	170.0	0.003	113.3	0.005	68.0	0.005	68.0
C	10.000 mg	20.0	50.0	20.0	50.0	60.0	16.7	55.0	18.2
Folic Acid	0.034 mg	0.10	34.0	0.20	17.0	0.4	8.5	0.4	8.5
Niacin	5.000 mg	7.6	65.8	9.6	52.1	18.0	27.8	13.0	38.5
Minerals									
Di-calcium phosphate	400.000 mg	450.0	88.9	450.0	88.9	450.0	88.9	450.0	88.9
Calcium Pantothenate	3.000 mg	..	..	..	..	..	..	..	..
Ferrous Sulphate	10,000 mg	18.0	55.6	18.0	55.6	20.0	50.5	30.0	33.3
Zinc Sulphate	36.000 mg	None set	..	..	..	..	..	..	..

MDR = Minimum Daily Requirement

14. LEAF PROTEIN

1.	Project location	:	Shri Avinashilingam Home Science College for Women Coimbatore, Tamil Nadu Work is being done on this project since 1969.
2.	Product details and raw materials used	:	Leaf protein (produced as given in 'processing details' below) 18 g Tapioca 40 g Ragi 10 g Sesame 2 g Jaggery 30 g
3.	Plant details - capacity etc.	:	No special plant is required for preparation of leaf protein contained supplementary food. Tapioca, ragi and sesame are roasted, mixed with leaf protein powder and then jaggery syrup is added to facilitate making of laddus.
4.	Processing details	:	Lucerne plants are harvested, washed, chopped and pulped by IBP pulper and filtered to protein-rich juice. This juice is then passed through a U-tube where it is curdled by injecting steam to raise the temperatureto 90°C, then filtered using standard cloth stocking and pressed into a cake by a beam press. This cake is suspended smoothly in water acidified to pH_4 with 2NHCl, filtered and pressed again. The product is air dried at 40°C to 50°C using a tray drier and ground to a fine powder.

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5. Nutritional data : Composition of 100 gm of leaf protein powder

Protein	55-60	g
Calcium	800	mg
Iron	50	mg
E. Carotene	1.4	µg
Calories	397	

6. Test results : Acceptability trials and tests have been conducted by the above college. Children accepted the product very well. During clinical examinations, heights, weights and haemoglobin levels were found only next to the SMP group. The general health of the children improved.

7. Distribution pattern : No large scale distribution has started.

8. Cost of production and distribution : It costs about Rs 4/- to produce 1 kg of leaf protein as against Rs 1/75 to Rs 2/50 per kg for groundnut flour and soya flour which also contain a similar percentage of protein.

9. Other information : This could be an appropriate technology for the North Eastern states where vegetation is in abundance and oilseeds are scarce.

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15. MILTONE

1.	Project location	: There are three plants in India - one in Bangalore, another in Ernakulam and the third in Hyderabad. All started in the early '70s. Two more plants will be installed with UNICEF assistance - one in Kanpur and the other probably at Calcutta.
2.	Product details and raw materials used	: Groundnut protein isolate; Wholesome cow's milk; Water; Sugar syrup; Vitamin-mineral mix.
3.	Plant details - capacity etc.	: Stainless steel tanks; Basket centrifuges; Multimill; Colloid mill; Mixing tank; Pasteurizer; Homogenizer; Bottle washing and filling units; Crown corking unit; Revolving sterilizer Sanitary dairy pumps; Laboratory equipment to control production.
4.	Processing details	: The process has been developed by the Central Food Technological Research Institute, Mysore and the highest Industrial Award for 1975 in USA was awarded for this achievement.

Each batch of 2,000 litres of Miltone is prepared as follows:

140 kg of edible groundnut flour is dispersed in 1,400 litres of water and treated with 2.8 litres of 40% solution of sodium hydroxide. The slurry is stirred for 30 minutes with a scraping tube agitator in the extraction tank to stabilize the protein in groundnut cake. The slurry is fed to a basket centrifuge to separate the insoluble residue from the clear extract. The residue is removed while the extract (1,300 litres) is treated with 50% hydrochloric acid to precipitate the protein which is recovered by centrifugation in the basket centrifuge. The pH of this solution is thus brought down to 5.0. The wet protein isolate (150 kg containing 60% moisture) is milled in a colloid mill.

2 gm of buffer salt per litre of emulsion is added while passing through the colloid mill. Buffer salt contains:

Sodium citrate	16 gm per 100 gm
Tri-calcium phosphate	50 gm per 100 gm
Calcium carbonate	34 gm per 100 gm

1,000 litres of protein emulsion is taken to the precipitation tank where sugar syrup (2% for pasteurized and 6% for sterilized product) and 1,000 litres of whole milk containing 3.8% fat, 8.5% SNF and vitamin premix (5 gm for 1,000 litres of Miltone and A+D concentration 7.5 ml per 1,000 litres of Miltone) are also added. The whole mixture of protein,

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milk and sugar is stirred and circulated through a plate heat exchanger and homogenizer. During circulation through the pasteurizer, steam is passed to raise the temperature of Miltone to 80°C and the temperature is held for 15-20 minutes. Steam is then cut off and chilled water is passed through the plates till Miltone attains a temperature of 20°C.

The product is then bottled or canned.

Each batch yields 280 kg of groundnut cake residue which can be dispensed with as cattlefeed.

In case bottles containing Miltone are to be sterilized, a rotary sterilizer can be employed. Sterilization is done at 1.5 atmospheric pressure for 15 minutes. Each batch of 1,200 bottles (200 ml) takes a period of four hours for this process. Sterilized Miltone contains about 6% sugar syrup, flavours and colours.

5. **Nutritional data** : Chemical composition of Pasteurized Miltone per 100 gm

Total solids	11.5	g
Fat	2.0	g
S.N.F.	9.5	g
Carbohydrates	5.0	g
Calories	54.0	
Vitamin A	150	IU
Vitamin C	3.0	mg
Vitamin D	40	IU
Thiamine	0.15	mg
Riboflavin	0.15	mg
Pyridoxine	0.20	mg
Niacinamide	1.0	mg
Cal.panthothenate	0.20	mg
Vitamin B_{12}	0.5	mg
Folic acid	5.0	mg
Protein	4.0	g

Extra sugar for sweetness, flavours and colours are provided for sterilized Miltone.

6.	Test results	: Elaborate tests have been conducted by CFTRI, Mysore.
7.	Distribution pattern	: This product is widely used for feeding programmes in Karnataka, Kerala and Andhra Pradesh; and also given to school children, pregnant and nursing mothers, and workers in the commercial organizations such as JAWA Ideal Ltd., Karnataka.
8.	Cost of production and distribution	: Cost of the production including raw materials is about Rs 1.50 per litre. Transport and other incidental charges are extra. Government sponsored programmes supply this product cheaper because of the subsidy.

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Production of 3,200 litres pasteurized Miltone for 3 days and 5,000 bottles sterilized Miltone for 3 days

Milk	1600 litres	@ Rs.1.60/litre	2,560.00
G.N.C.	160 kgs	@ Rs.2.46/kg	393.92
Sugar	64 kgs	@ Rs.5.60/kg	358.40
Vitamins @ Rs.60/- per	1000 litres		19.20
Acid	5.6 litres	@ Rs.4.77/litre	26.71
Alkali	4 kgs	@ Rs.6.00/kg	24.00
Detergents			3.00
	Total raw materials		3,385.23
	Labour and supervision		207.00
	Services @ Rs.0.25/litre		704.00
	Indirect costs		61.64
	Total		4,357.87
	Deduct cost of residue 250 kg @ Rs.0.25/kg		62.50
	Total cost of 3,200 litres of pasteurized Miltone		4,295.37

Price per litre of Miltone = Rs 1.3423

Sale price can be fixed @ Rs 1.40 per litre

Staff	
7 workers at	44
1 worker	5
4 workers	14
3 assistants	29
	92
Supervisor	115
	207

Labour		
Production manager		39.84
Technical Assistant	-1)	
Sales Assistant	-1)	75.16
Lab. Attendant	-1)	
Plant Operator	-1)	
		115.00

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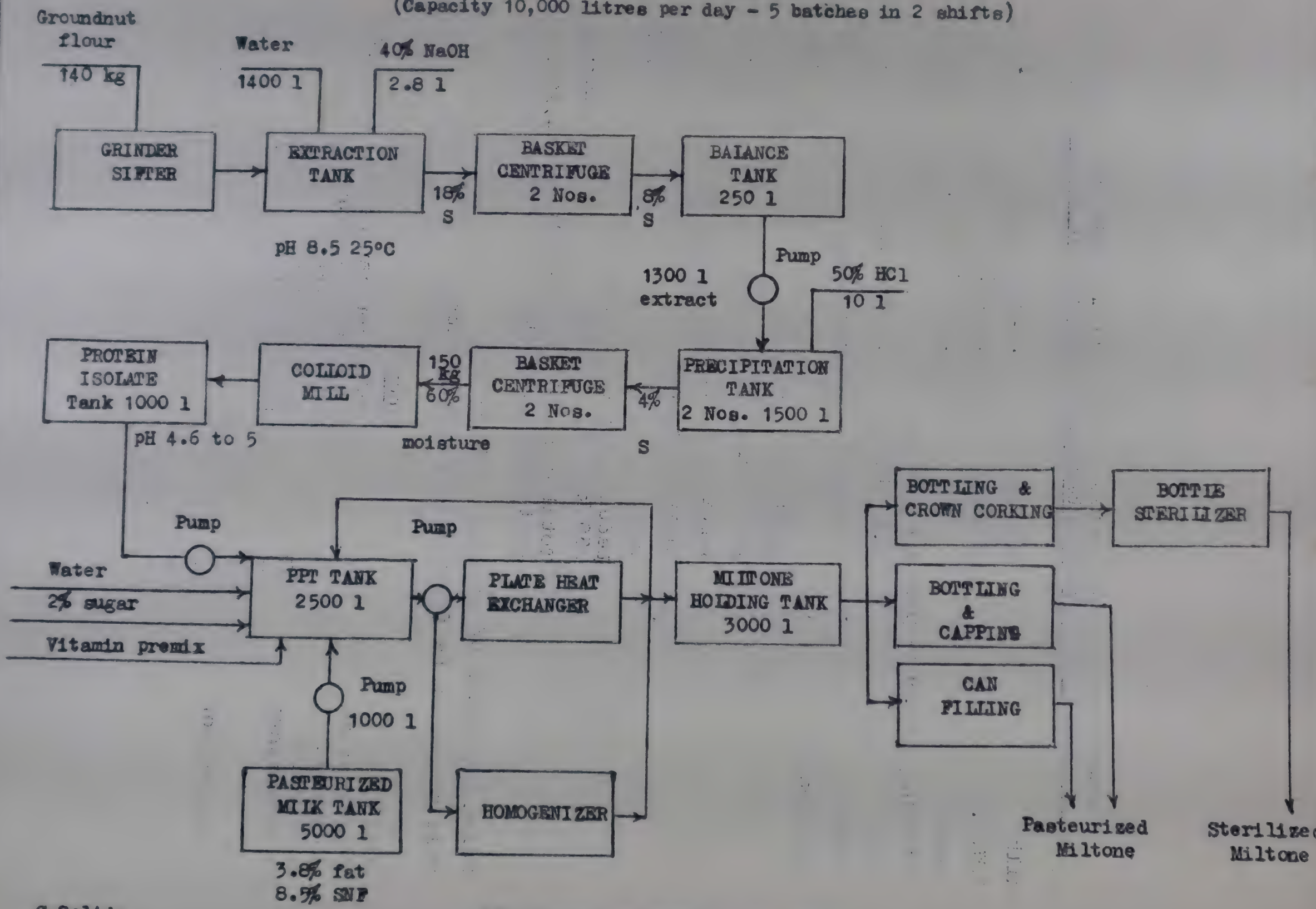
BLOCK DIAGRAM - MILTONE PLANT

(Capacity 10,000 litres per day - 5 batches in 2 shifts)



S-Solids

2000 litres of Miltone per batch

FVT/4.11.1977

16. K-MIX-2

1. **Project location** : Kaira District Cooperative Milk Producers' Union Ltd. Anand, Gujarat.

   Initially manufactured abroad in 1966. Prepared by dry mixing at Anand in 1974.

2. **Product details and raw materials used** : Calcium caseinate 3 parts
   Skim milk powder 5 parts
   Sugar 10 parts

3. **Plant details - capacity etc.** : The above requires only dry mixing in hygienic conditions and a packaging line.

4. **Processing details** : Since then, KM-4, KM-5 and KM-6 have been developed with various formulations given on page 49. All formulations give the required protein and calorie content per 100 gm of product. KM-4 and KM-5 are roller dried products and have been proved comparable with K-Mix-2 in the properties.

5. **Nutritional data** : Composition per 100 gm of product

	Protein	Calorie
K-Mix-2	26	400
K-Mix-4	24	382
K-Mix-5	24	382
K-Mix-6	22	370

With oil included, the required amount of protein and calories will be covered during the feeding period.

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6. Test results : Tests have been conducted by the All India Institute of Medical Sciences, New Delhi and field trials during the Bangladesh Refugee Relief and Special Child Relief Programmes.

7. Other information : Preparation of K-Mix-2

1. Measure K-Mix-2.
2. Add oil.
3. Mix the K-Mix-2 and oil briskly.
4. Slowly add warm water (previously boiled and cooled), stirring constantly to provide a smooth consistency and bring just to the boil.
5. Serve while the feed is still lukewarm.
6. Stir the mixture from time to time while serving. This keeps the oil properly mixed so that it does not float on the surface. It is very important to do this frequently.

KWASHIORKAR FOOD MIXTURES FOR NUTRITION THERAPY

CODE	Ingredients	Formulations gms/100 gm mix	Values per 100 gm of product Protein	Calories
K-M-2	Calcium caseinate (3) SMP (5) Sugar (10)	116.6 27.8 55.6	22	370
	Feed/child/day K-M-2 Oil	150.0 40.0	40	1000
K-M-4	Skim milk powder Sugar Wheat flour Full fat soya flour*	20.0 30.0 10.0 40.0	24	382
	Feed/child/day K-M-4 Oil	175.0 40.0	42	1028
K-M-5	Skim milk powder Sugar Full fat soya flour*	20.0 40.0 40.0	24	382
	Feed/child/day K-M-5 Oil	175.0 40.0	40	1072
K-M-6	Skim milk powder Sugar Potassium Chloride Magnesium Hydroxide	62.0 37.0 0.07 0.03	22	370
	Feed/child/day K-M-6 Oil	150.0 54.0	33	1041

Note: * Vitamin mix (no minerals) as per SWF formulation;
Feeds : 2 or 3 times a day; oil added at feeding centres.

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17. CINI - NUTRIMIX

1.	Project location	:	Child in Need Institute (CINI) 197/722 Diamond Harbour Road Thakurpukur Calcutta 700063. The project has been in operation since 1976.
2.	Product details and raw materials used	:	Wheat/Rice 70 parts Moong dal 20 parts Skim milk powder 5 parts
3.	Plant details - capacity etc.	:	No special plant is required except cast iron pans and coal fired 'chulas' (ovens).
4.	Processing details	:	Roast wheat/rice and moong dal separately in cast iron pans over coal fired chulas. The women trained in this programme learn to judge the proper roasting by colour change and odour. The cooled ingredients are then mixed and crushed in the mills making wheat flour (atta) in the villages. The mixture is then packed in poly-ethylene bags of 450 gm.
5.	Nutritional data	:	In addition to other nutrients, a 450 gm packet of the product provides 1,735 calories and 84.5 g protein.
6.	Distribution pattern	:	4-5 teaspoons of the mix is boiled with water or milk adding sugar/gur to taste. The children are fed 4-5 times a day.

7. Cost of production and distribution : A nominal charge of 25 paise per packet is charged from recepients. 300 packets are made each week. During January ~~1~~-December 1976 the following were used:

Wheat	18459 kg	supplied free by Catholic Relief Services
SMP	8325 kg	supplied free by European Economic Community through the Seva Kendra, Calcutta.
Moong dal	4092 kg	purcahsed locally.

Efforts are now being made to discontinue the poly-packs and use empty containers for refilling during weekly visits.

8. Other information : In 1976, about 125 mothers were trained.

About 4,000 children benefitted from the programme during January-December 1976. Approximately 36,361 packets were distributed during this period.

The community is involved in this programme in different ways:

- selected mothers get training to become child health visitors;
- pre-school children are recommended for participation in the programme based on socio-economic and nutritional status;
- rent-free storage accommodation is provided for ingredients and centres at which the supplement is mixed and packed;
- stored ingredients are guarded free of charge;
- children under five are benefitted.

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COMMUNITY HEALTH CELL
47/1, (First Floor) St. Marks Road,

18. SHAKTI MALT

1.	Project location	: Lakshmi Seva Sangh Gandhigram 624302 Tamil Nadu
2.	Product details and raw materials used	: Ragi Wheat Palm sugar Flavours Jowar and cambu can also be used.
3.	Plant details-capacity etc.	: The unit, housed in a building measuring 1200 sq ft, is equipped with - steeping tanks; - couching trays; - roaster; - polisher; - pulverizer; - air separator; - ball-mill; - weighing machines; - packaging line. The capacity of the plant is 60 kgs/day of 8 hours.
4.	Cost of production and distribution	: The manufacturing cost of 3600 packets (350 gm each) is Rs 8,700. A 350 gm packet is being sold at Rs 4.50. "Ragotine", a commercial product of this nature, is being sold in the market at Rs 13/- per 800 gm tin and Rs 8/- per 400 gm tin.

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COMMUNITY HEALTH CELL
326, V Main, I Block
Koramangala
Bangalore-560034
India

19. MIRPUR MIX - BANGLADESH

1. **Project location** : Mirpur
Dacca
(A small co-operative venture)

In operation since late 1975.

2. **Product details and raw materials used** : Pre-cooked mixture of

roasted rice;
wheat;
pulses;
groundnuts;
dried fish.

3. **Plant details - capacity etc.** : No special plant is available.

4. **Processing details** : This is proved to be suitable as a supplement to the ordinary home food. Can be prepared as gruel, porridge, chappattis, etc.

5. **Nutritional data** :

Protein	17	g
Fat	5.6	g
Calcium	530	mg
Iron	0.7	mg
Calorie	360	kcal/100 g dry infant food

6. **Test results** : Analyses have been conducted at the Nutrition Institute, University of Uppasala, Sweden.

7. **Cost of production and distribution** : The cost of the product is 4 takas* per lb. Transportation charges are extra.

8. **Other information** : To improve the vitamin content and vary the taste, leaves and vegetables can be cooked, mashed/chopped and added to the mix. Fruits can also be added in the same way to the mix. Sugar or salt can be added to taste.

*Taka 15.45 = $1

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20. SUPER FLOUR (SARBOTTAM PITHO) - NEPAL

1. Project location : Shanta Bhavan Hospital
Kathmandu
Nepal.

2. Product details and raw materials used : Roasted soya flour 50%
Roasted corn flour 25%
Roasted wheat flour 25%

3. Processing details : The two cereals and one legume are roasted, ground, mixed and cooked into a porridge to make it into an acceptable food for children.

4. Nutritional data : Composition per 100 gm

Protein	20.7	%
Fat	8.3	%
Carbohydrates	53.0	%
Energy	366.0	Kcal
Calcium	400.0	mg
Iron	14.0	mg
Carotene (Provitamin A)	430.0	IU
Thiamine	0.92	mg
Riboflavin	0.45	mg
Niacin	7.00	mg
Folic acid	0.32	mg

5. Test results : Clinical results and community acceptability were confirmed by trials in village homes and in a small rehabilitation unit. Super porridge is encouraged as first supplementary food to breast milk. The combination of local cooking methods and available foods resulted in a socially acceptable product that villagers produce at home to combat easily recognized malnutrition in children.

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21. WEANING FOOD "DONGO" - KENYA

1. **Project location** : Medical Research Council Project
P.O. Box 1971
Kisumu
Kenya.

Coverage of villages Masogo, Nyamware, Kapiyo, Kowih and Kogwen.

2. **Product details and raw materials used** :

	gm
Maize	62.5
Sesame	17.5
Groundnut	10.0
Green gram	10.0
Vegetable oil	9.0
	106.5

The above raw materials have been selected because of

- easy availability locally;
- maize as source of energy;
- sesame, groundnuts and green gram being available for almost the same price, adding energy and protein content without adding thickness;
- vegetable fat to 'top up' the energy concentration.

3. **Plant details - capacity etc.** : The small village factory has a grinder, IT groundnut sheller supplied by UNICEF, a hand operating testa removing machine and a block maker.

At present, the factory is preparing sixty 7-block packs a day. The blocks are then packed in high density polyethelene bags with a two colour label printed on it.

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4. Processing details : All ingredients except oil, sugar, vitamin mix and groundnuts are mixed and ground together in a large mill. Groundnuts are milled separately in a handmill. Fresh groundnuts are purchased and shelled in the factory with the aid of the UNICEF-supplied IT groundnut sheller. Sieves are used for separating shell fragments from nuts. Final sorting is done by hand winnowing. A hand operated testa removing machine is used for removing brown testa in order to have an agreeable colour of the product, A block press is made for making blocks of DONGO, ultimately to be packed in high density polyethelene bags.

5. Nutritional data : Composition per 1 block (106.5 gm)

Calories	502	
Protein	15.7	g
Sulphur content amino acids	413.0	
Lysine	561.2	mg
Calcium	285.0	mg
Riboflavin	0.16	mg
Iron	20.0	mg
Niacin	3.7	mg
Vitamin A (retinol)	2.25	mg
Vitamin C	0.0	mg
Thiamine	0.5	mg

6. Test results : Initial tests have proved that children with weight above 90 per cent standard before DONGO distribution was 50 and it was 70 after distribution. Total number of children covered under survey was 200 in the age group 6 months - 4 years. An evaluation trial is being undertaken on the effect of this low cost weaning food as per the Progress Report No. 1 of 24 June 1977. It is hoped that sufficient data will be available on the acceptability and benefits of weaning food and prospects of a long term production programme. No problems of deterioration or rancidity have been encountered.

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7. Distribution pattern: 500 ml of water is added to one block to give correct energy.

To prepare, add little water and make a paste of the product and then boil balance of water. Add the paste and stir to bring it to the correct consistency. Porridge prepared with one block of DONGO provides one-half of a child's daily energy and protein requirement for a child of one year. When prepared as above, it has high energy and low bulk.

8. Cost of production and distribution : DONGO costs 1.40 shillings per 7-day supply or 25 cents per block.

9. Other information : DONGO means growth.

It is estimated that a sum of $7,000 will be required to run a DONGO clinic on a self-help basis for 300 children for 3 months.

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BALANCED DIETS FOR CHILDREN

	Pre-School Children				School Children			
	1-3 Years		4-6 Years		7-9 Years		10-12 Years	
	Vege-tarian (gm)	Non vege-tarian (gm)	Vege-tarian (gm)	Non vege-tarian (gm)	Vege-tarian (gm)	Non vege-tarian (gm)	Vege-tarian (gm)	Non vege-tarian (gm)
Cereals	150	150	200	200	250	250	320	320
Pulses	50	40	60	50	70	60	70	60
Green leafy vegetables	50	50	75	75	75	75	100	100
Other vegetables) Roots and tubers)	30	30	50	50	50	50	75	75
Fruits	50	50	50	50	50	50	50	50
Milk	300	200	250	200	250	200	250	200
Fats and oils	20	20	25	25	30	30	35	35
Meat and fish) Eggs)	..	30	..	30	..	30	..	30
Sugar and jaggery	30	30	40	40	50	50	50	50

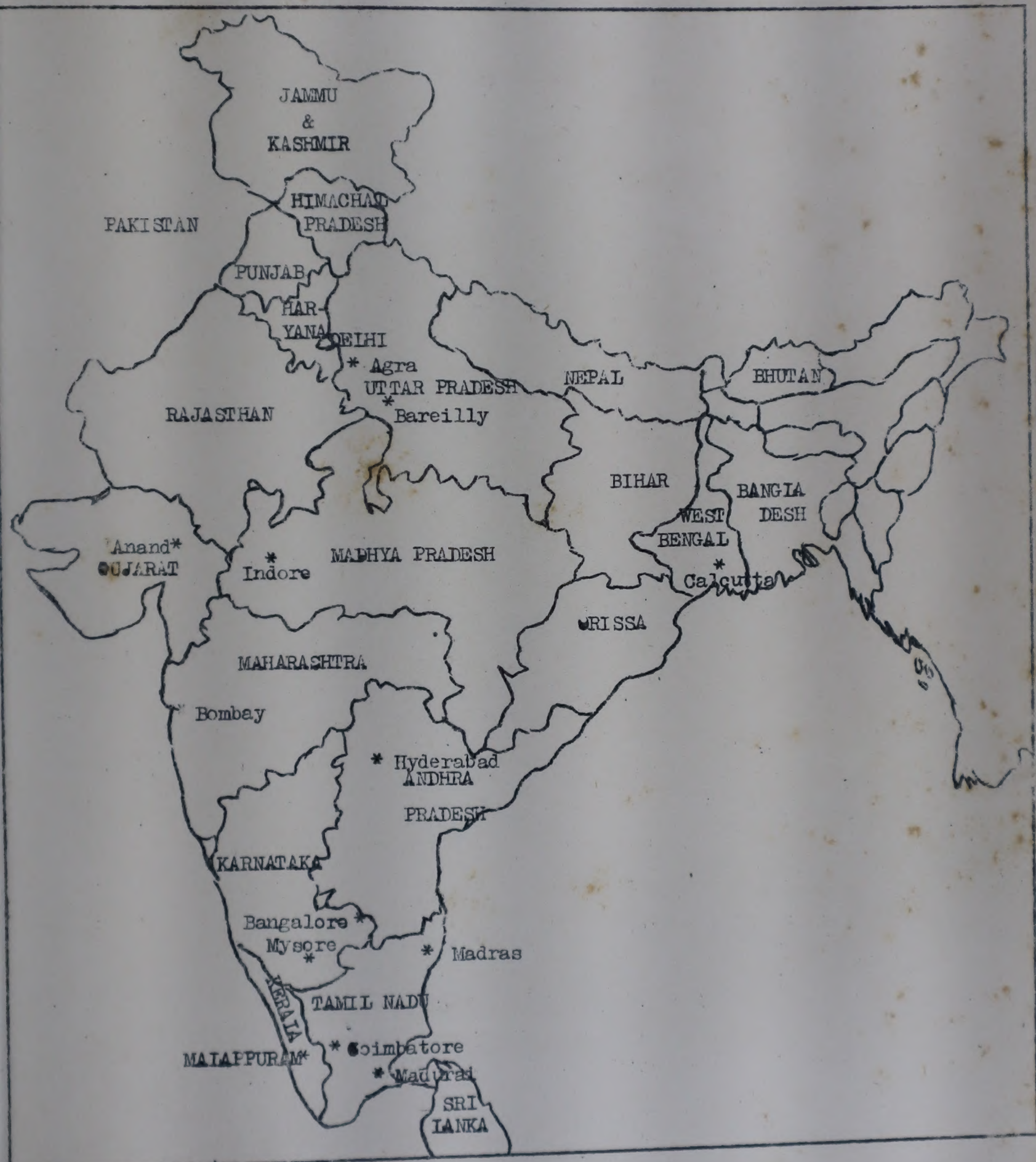
Source: ICMR Special Report Series No. 60 of January 1971.

Daily Allowances of Nutrients for Indians

(Recommended by the Nutrition Expert Group in 1968)

Group	Particulars	1 Net calories	2 Proteins (gm.)	3 Calcium (gm.)	4 Iron (mg.)	5 Vitamin A Retinol (μg.)	5 Vitamin A β-carotene (μg.)	6 Thiamine (mg.)	7 Riboflavin (mg.)	8 Nicotinic acid (mg.)	8 Ascorbic acid (mg.)	9 Folic acid (μg.)	10 Vitamin B (μg.)	11 Vitamin D (I.U.)
Man	Sedentary work	2400	55[a]	0.4-0.5	20	750	3000	1.2	1.3	16		100	1	
	Moderate work	2800						1.4	1.5	19				
	Heavy work	3900[a]						2.0	2.2	26				
Woman	Sedentary work	1900	45[a]	0.4-0.5	30[a]	750	3000	1.0	1.0	13		100	1	
	Moderate work	2200						1.1	1.2	15	50			
	Heavy work	3000						1.5	1.7	20				
	Pregnancy	+300	+10[a]	1.0	40[b]	750	3000	+0.2	+0.2	+2	50	150-300[a]	1.5	
	(second half of pregnancy													
	Lactation (up to 1 year)	+700	+20[a]		30[a]	1150	4600	+0.4	+0.4	+5	80	150		
Infants	0—6 months	120/kg.	2.3-1.8/kg.[b]	1.0 mg./kg.		400					30	25	0.2	200
	7—12 „	100/kg.	1.8-1.5/kg.	0.5-0.6[a]		300	1200							
Children	1 year	1200	17	0.4-0.5	15-20	250	1000	0.6	0.7	8	30-50	50-100	0.5-1.0	
	2 years		18											
	3 years		20											
	4—6 years	1500	22			300	1200	0.8	0.8	10				
	7—9 years	1800	33			400	1600	0.9	1.0	12				
	10—12 yeas	2100	41			600	2400	1.0	1.2	14				
Adolescents	13—15 yrs. Boys	2500	55	0.6-0.7	25	750	3000	1.3	1.4	17				
	Girls	2200	50		35			1.1	1.2	14				
	16—18 yrs. Boy	3000	60	0.5-0.6	25	750	3000	1.5	1.7	21				
	Girls	2200	50		35			1.1	1.2	14				

Source: ICMR Special Report Series No: 60 of January 1971.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